NELSON MANDELA

UNIVERSITY

Marine Robotics Unit

MRU Solar Boat

Presented by Elbert Liebenberg

Introduction

- Electronic setup
  - Components used – Hardware, Software
- Basic operation
  - Mission setup
  - Mission execution
  - Log data storage
  - Data post processing
  - Mission setup (video)

Autonomous solar boat - construction

External

- Motors – Two 34lb thrust trolling motors
- 2 x Lithium Iron Phosphate 1400 Wh batteries
- 6 x 50W Flexible solar panels
- Max speed achieved 2.4 m/s

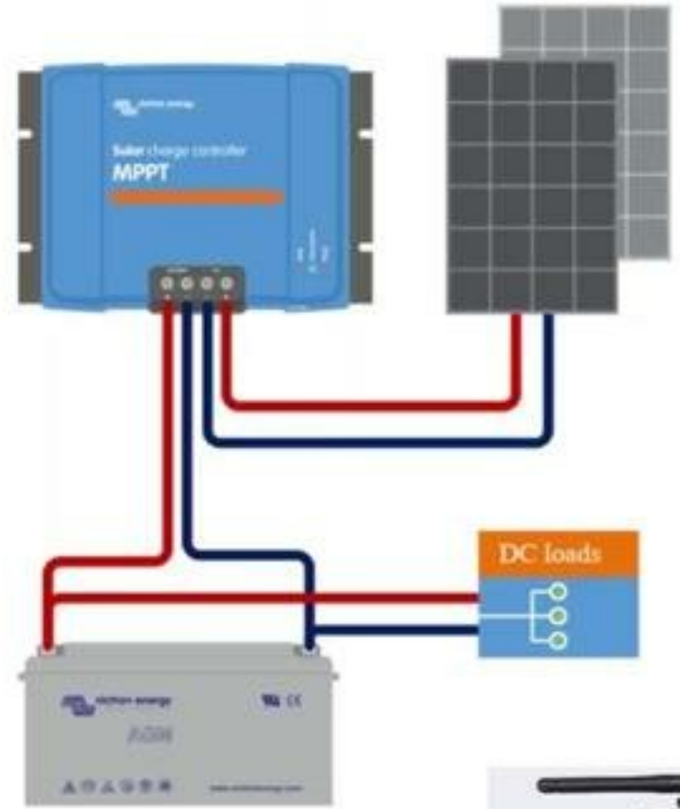
Autonomous solar boat - Hardware

Power distribution

- Maximum Power Point Tracker (MPPT)
- Brushed motor driver for 2 x 60A

Control & signal processing

- Pixhawk flight controller
- GPS for navigation
- Communication 868 MHz Radio - 40 km line of sight
- Radio controller transceiver
- Arduino Mega – Companion compute for data logging



Software

Off the shelf – Free

Configuration Software

ARDUPILOT

QGroundControl

Sensor payload

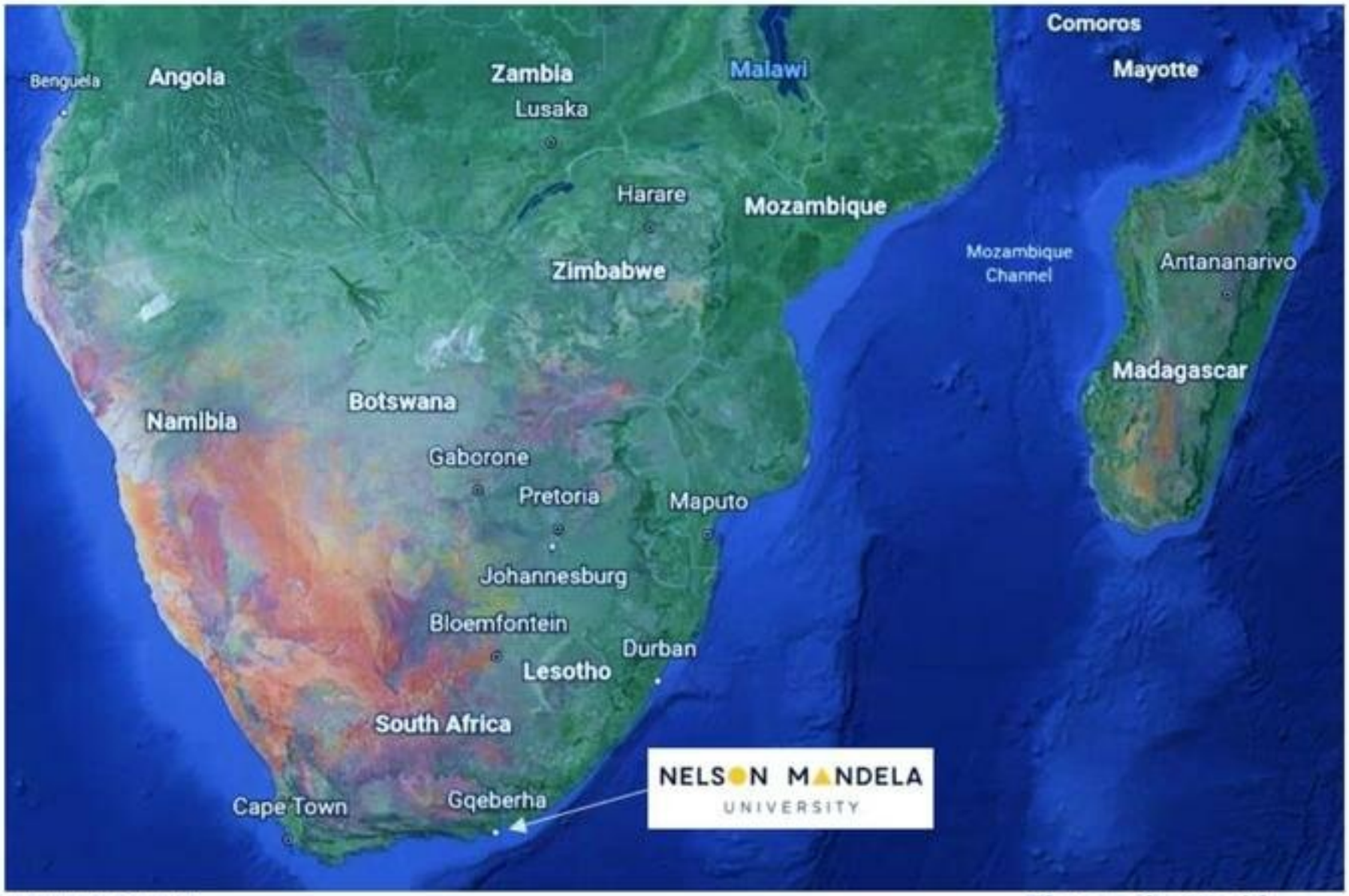
- Ping - down scan sonar
- Temperature sensor

Communication Interface

- Taranis X90 Plus Radio Controller
- 868Mhz Telemetry radio

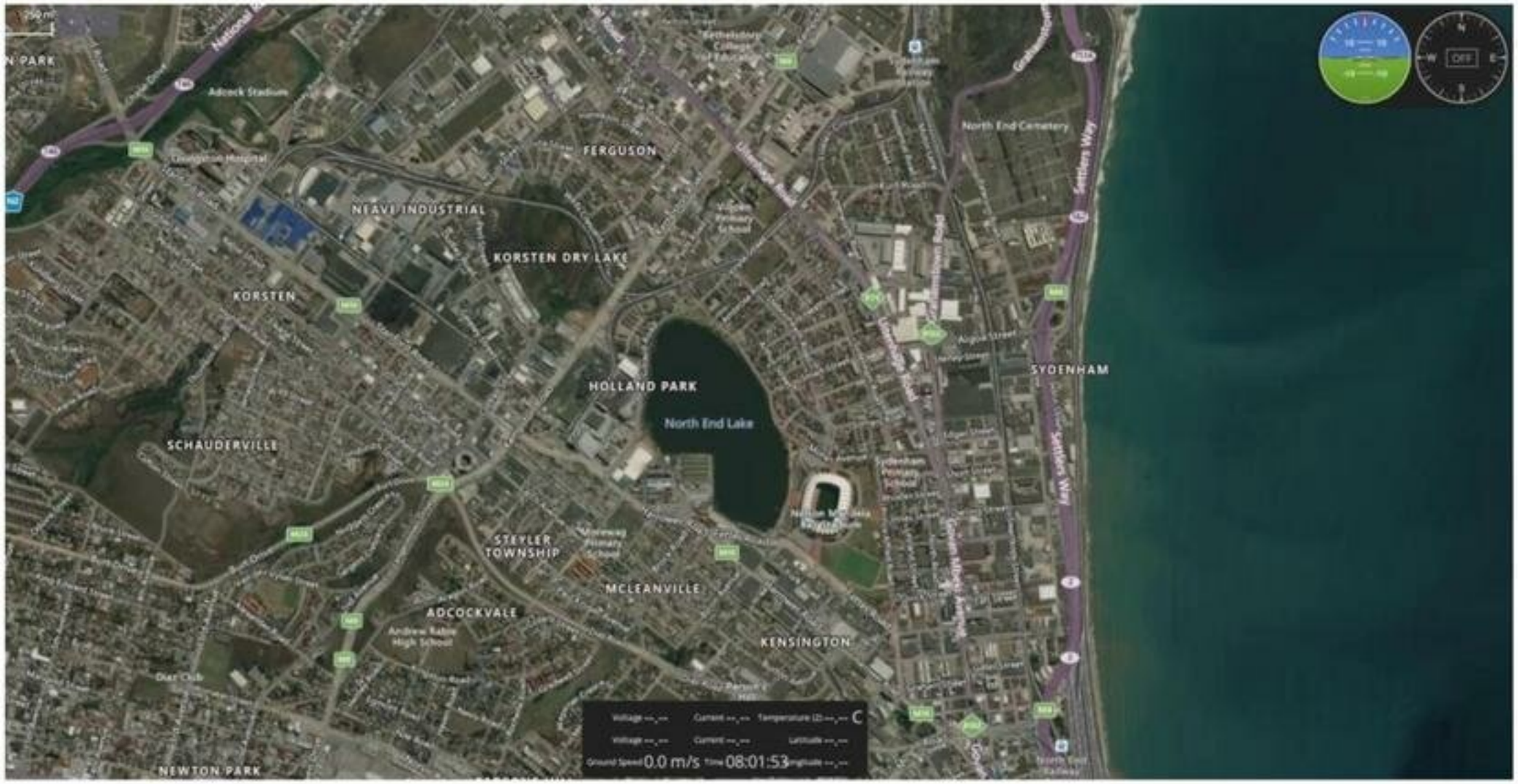
Running a mission

1. Selecting scan type
2. Path planning
3. Setting parameters
4. Monitoring progress
5. Process data



Operation – mission setup

North End Lake



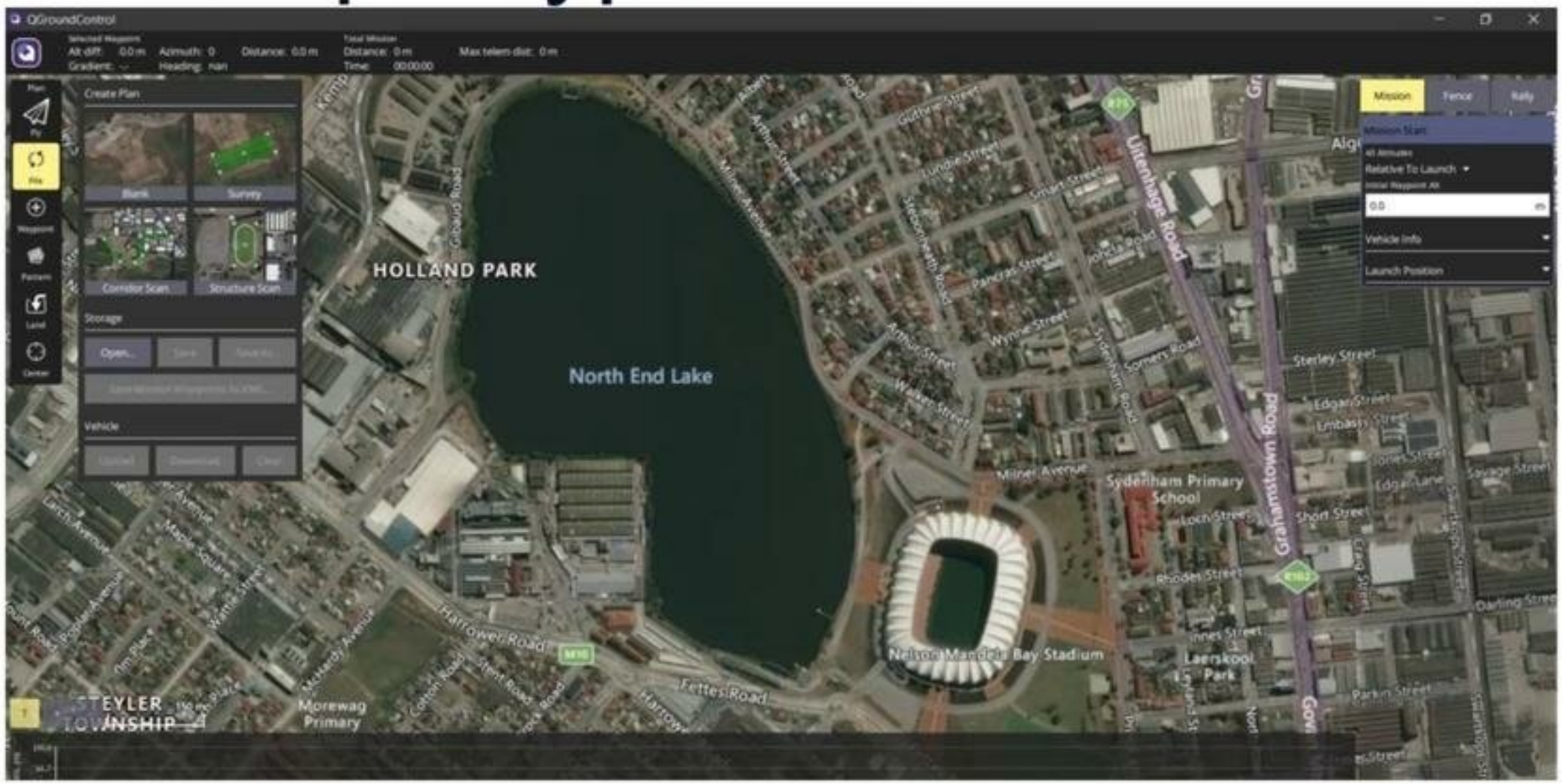
North End Lake

Mission setup - location

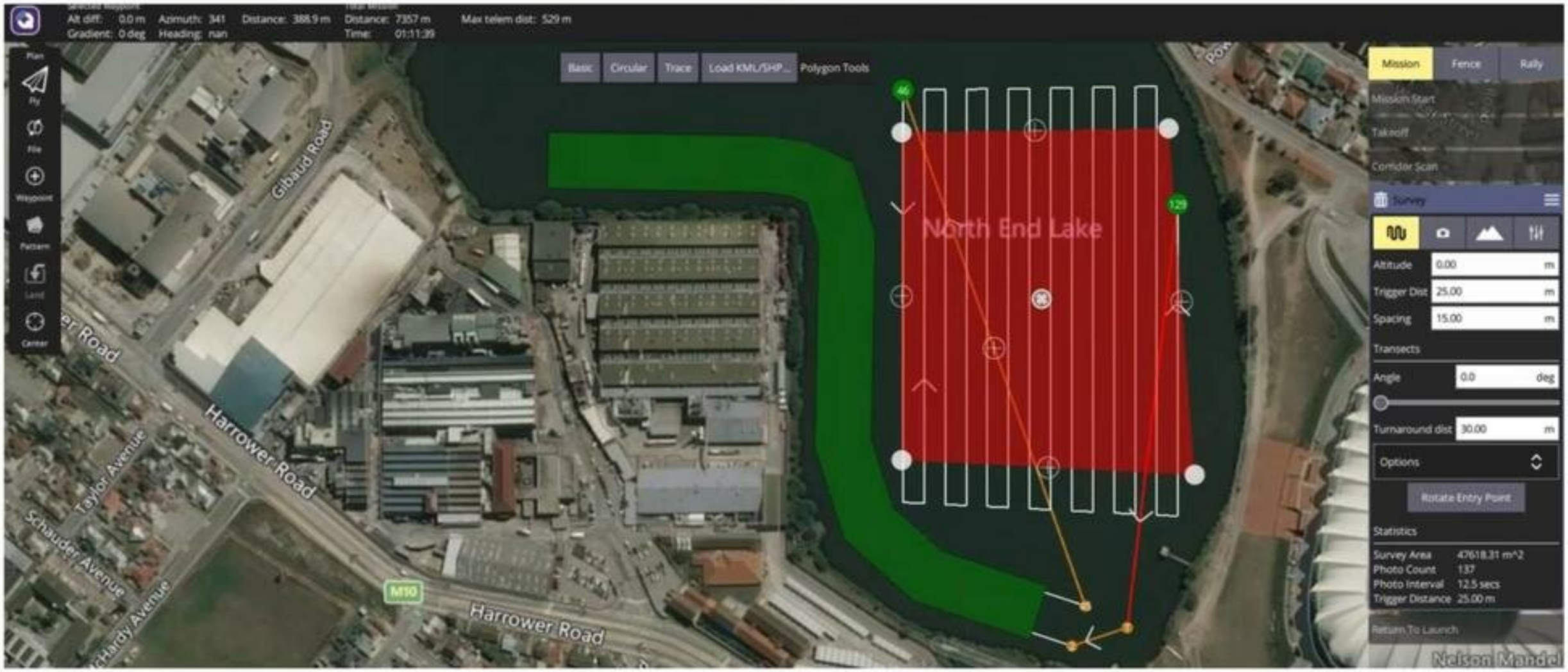
- Typical starting screen
- If connected GPS will auto home to boat location

Mission setup – type

- Mission type
  - Blank
  - Survey
  - Corridor

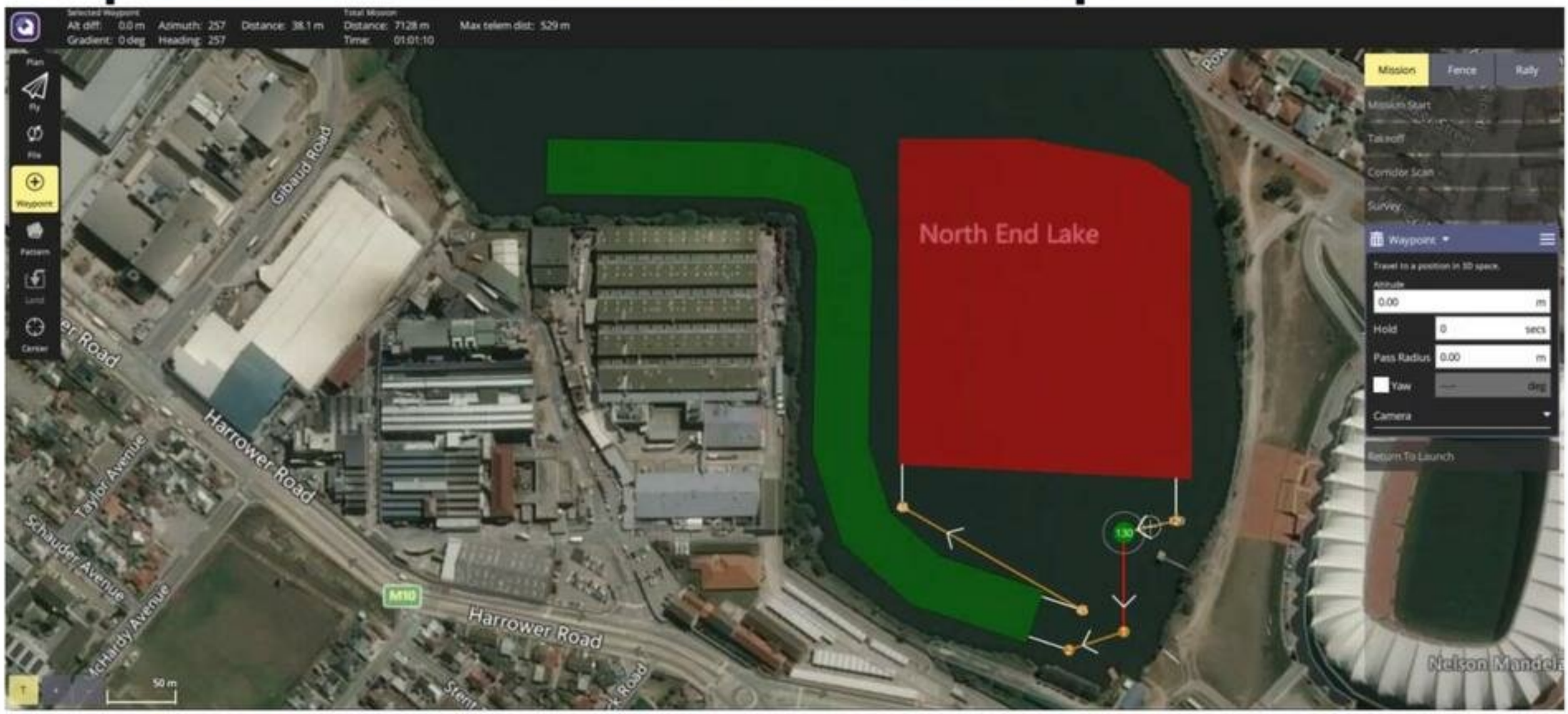


Mission setup - layout

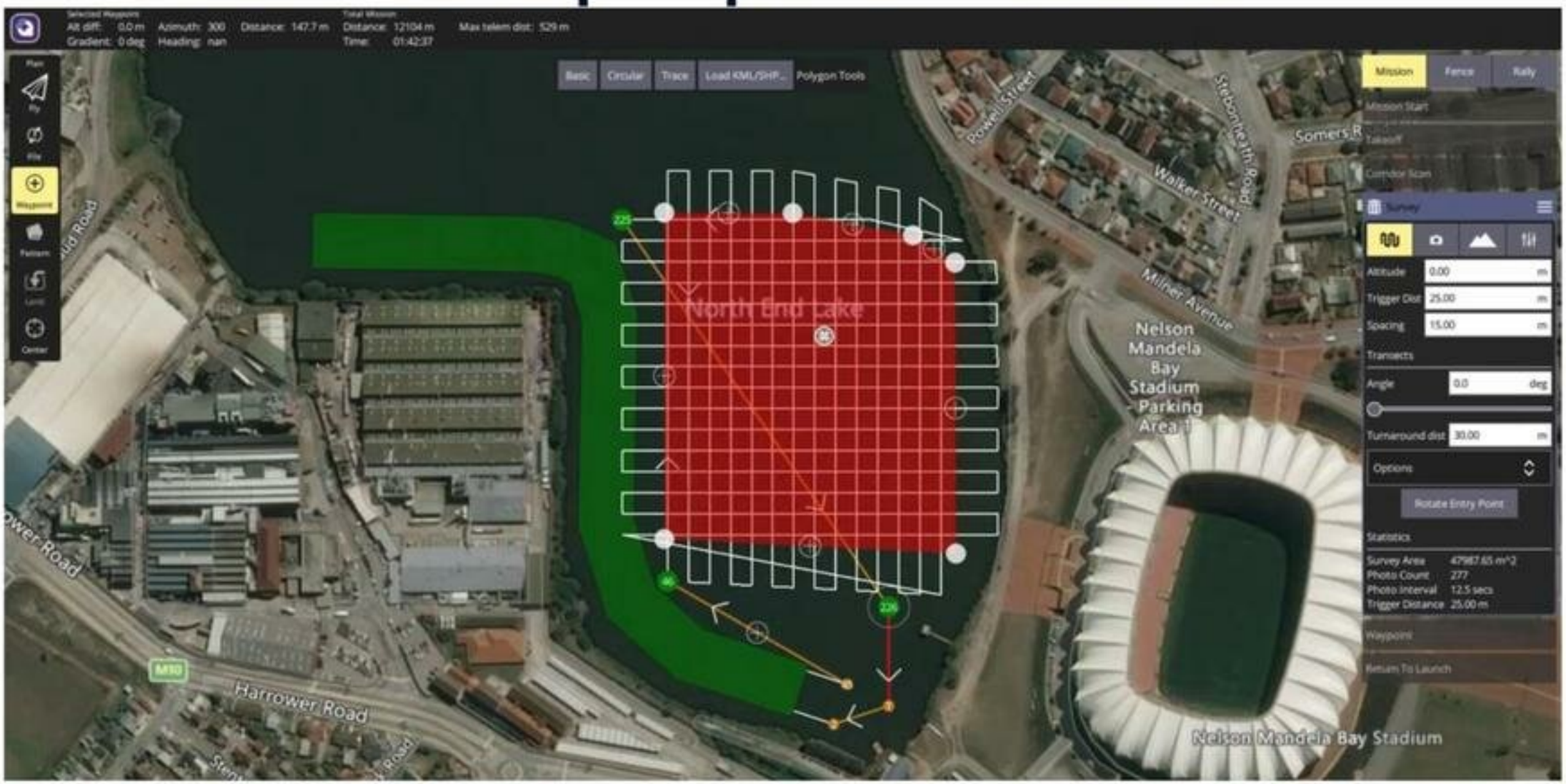


Mission setup - parameters

Operation – mission setup

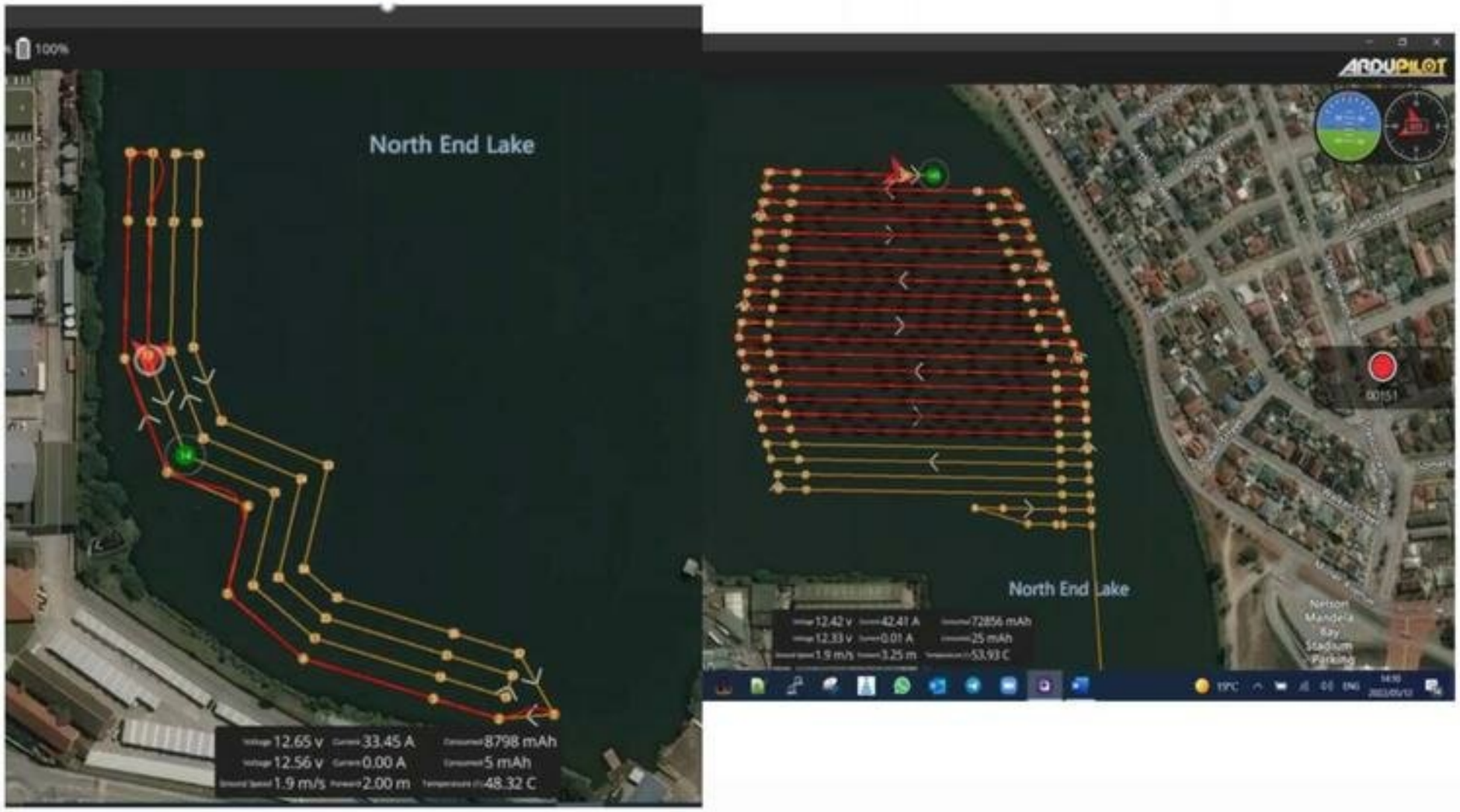


Mission setup - parameters

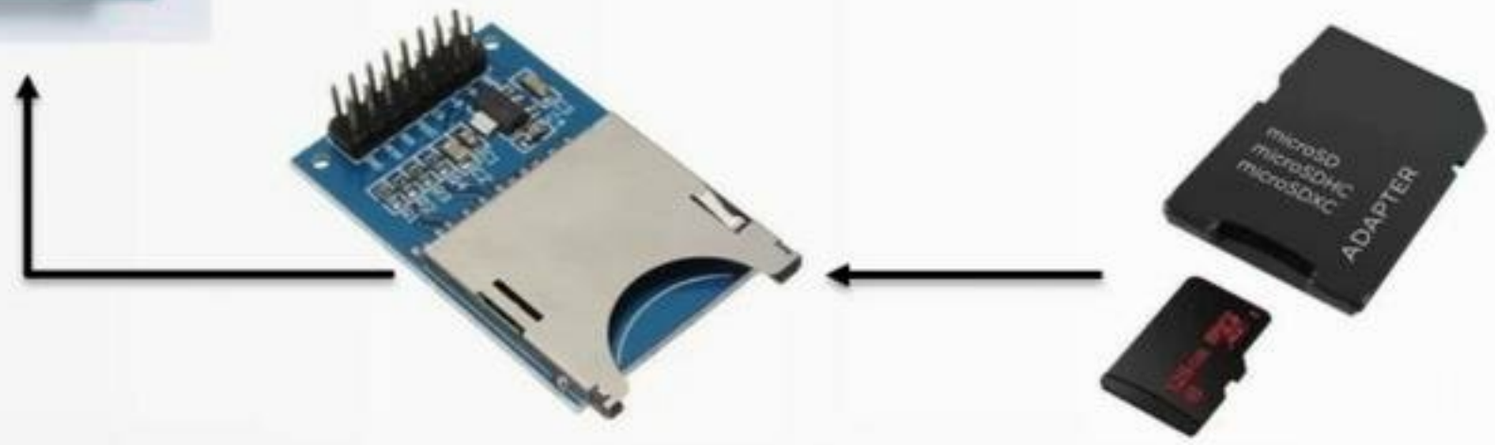


Corridor & survey scan - execution

- Path following
- Speed control
- Loiter at waypoint
- Change speed
- Execute command
- Smart RTL



- Log files are created by companion computer
- Stored as .txt format on external SD card
- Separate log files from controller



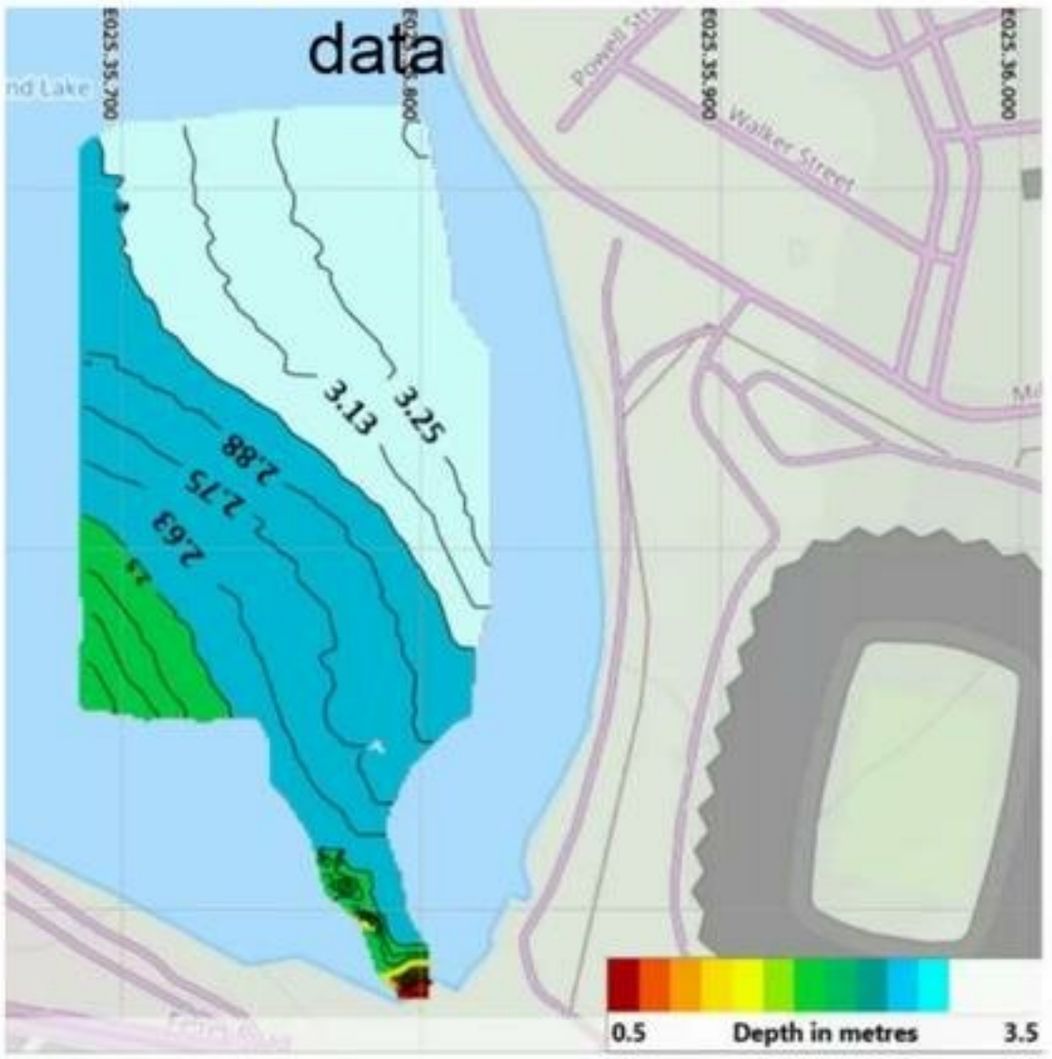
- Processed data

scan

- Planned path

- Data points

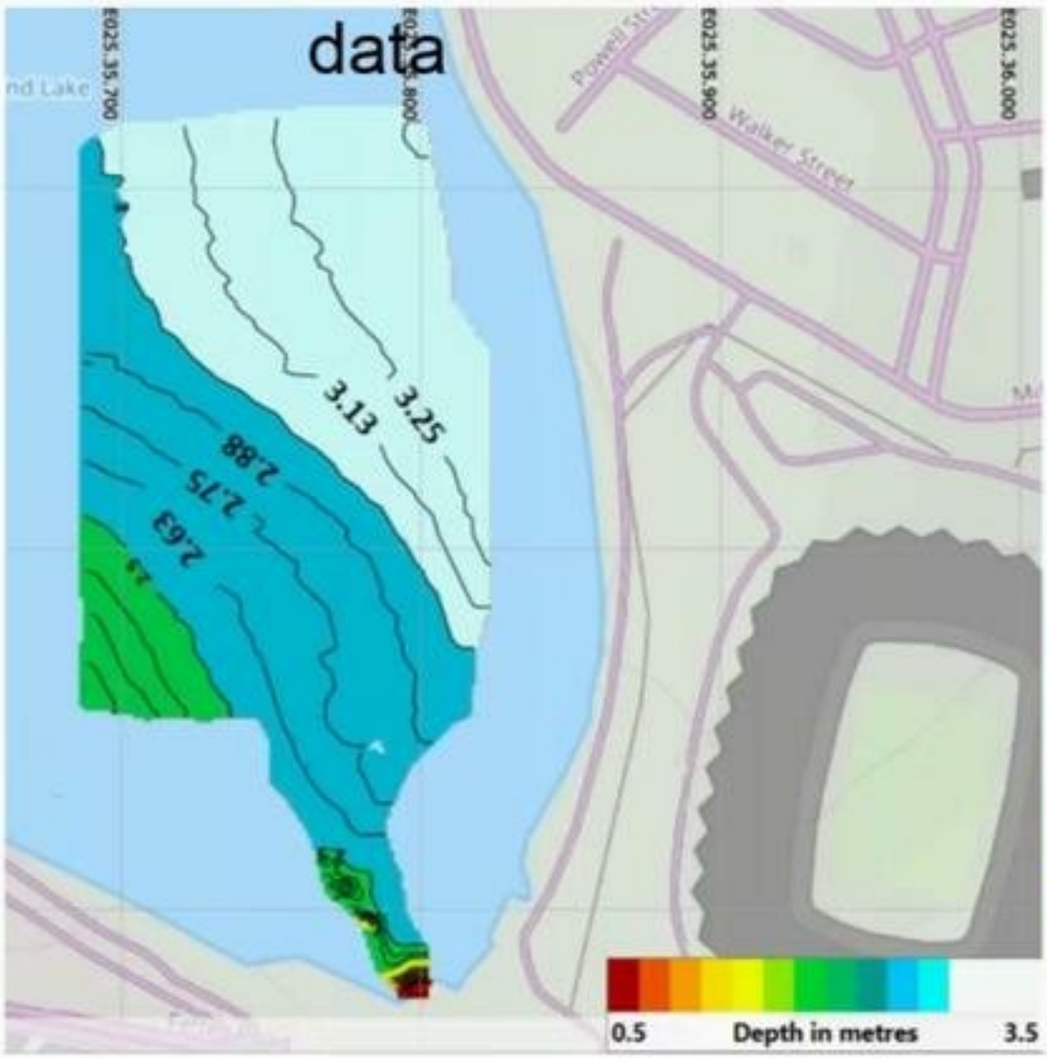
- Processed data



Survey scan

- Data points

- Processed data



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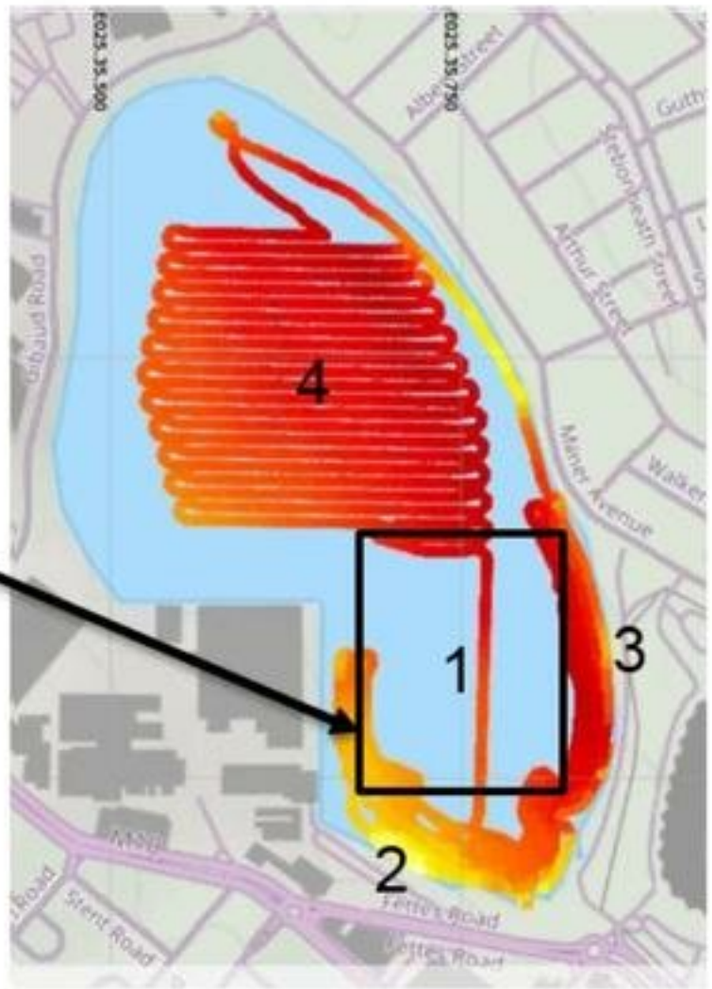
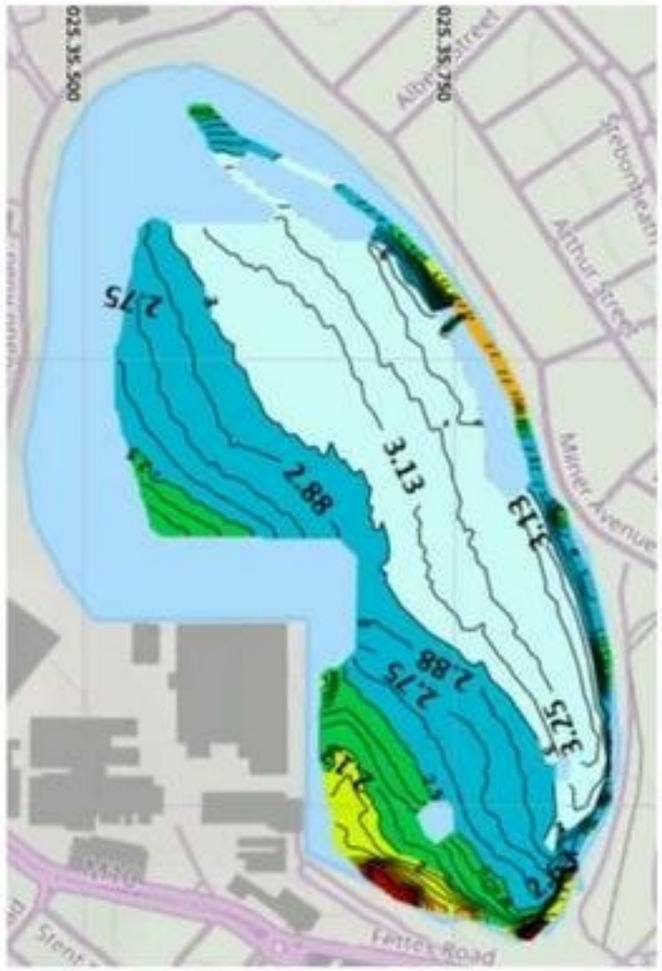
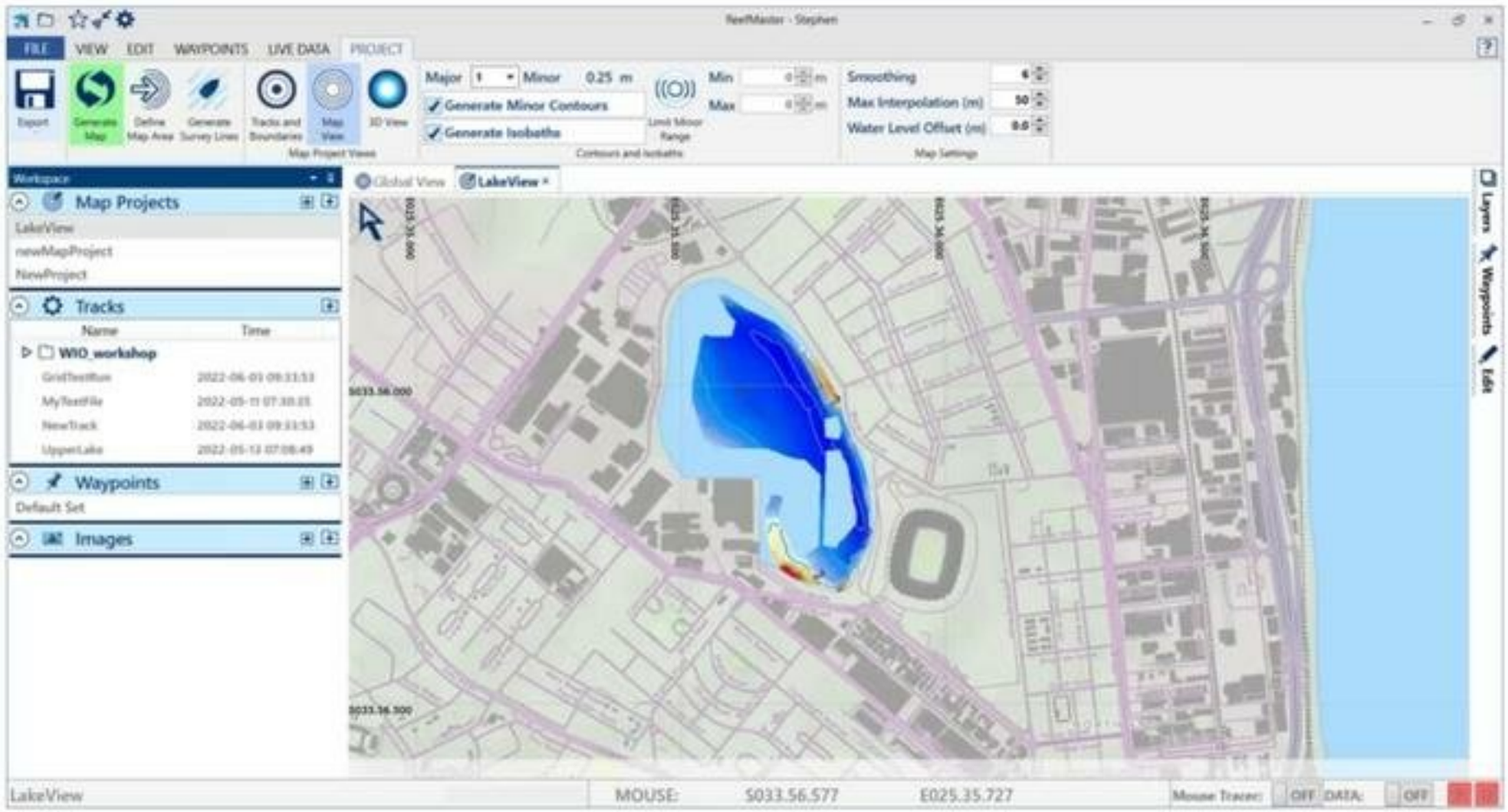
Combining scan data



- Combined

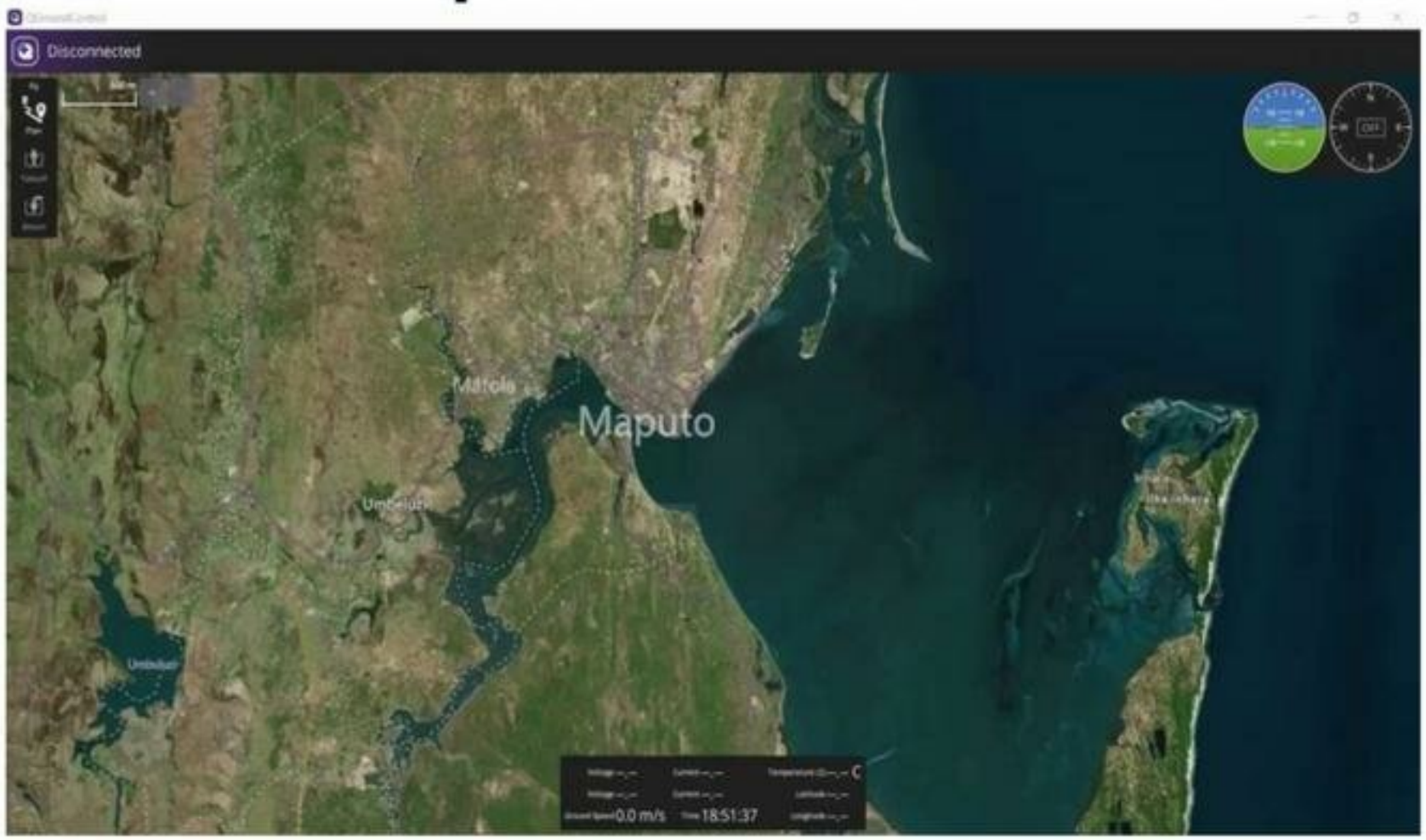


Post processing



- Reef master – sonar viewer
- Create 3D bathymetric maps
- Side scan

Mozambique demo - location



Mozambique demo - location

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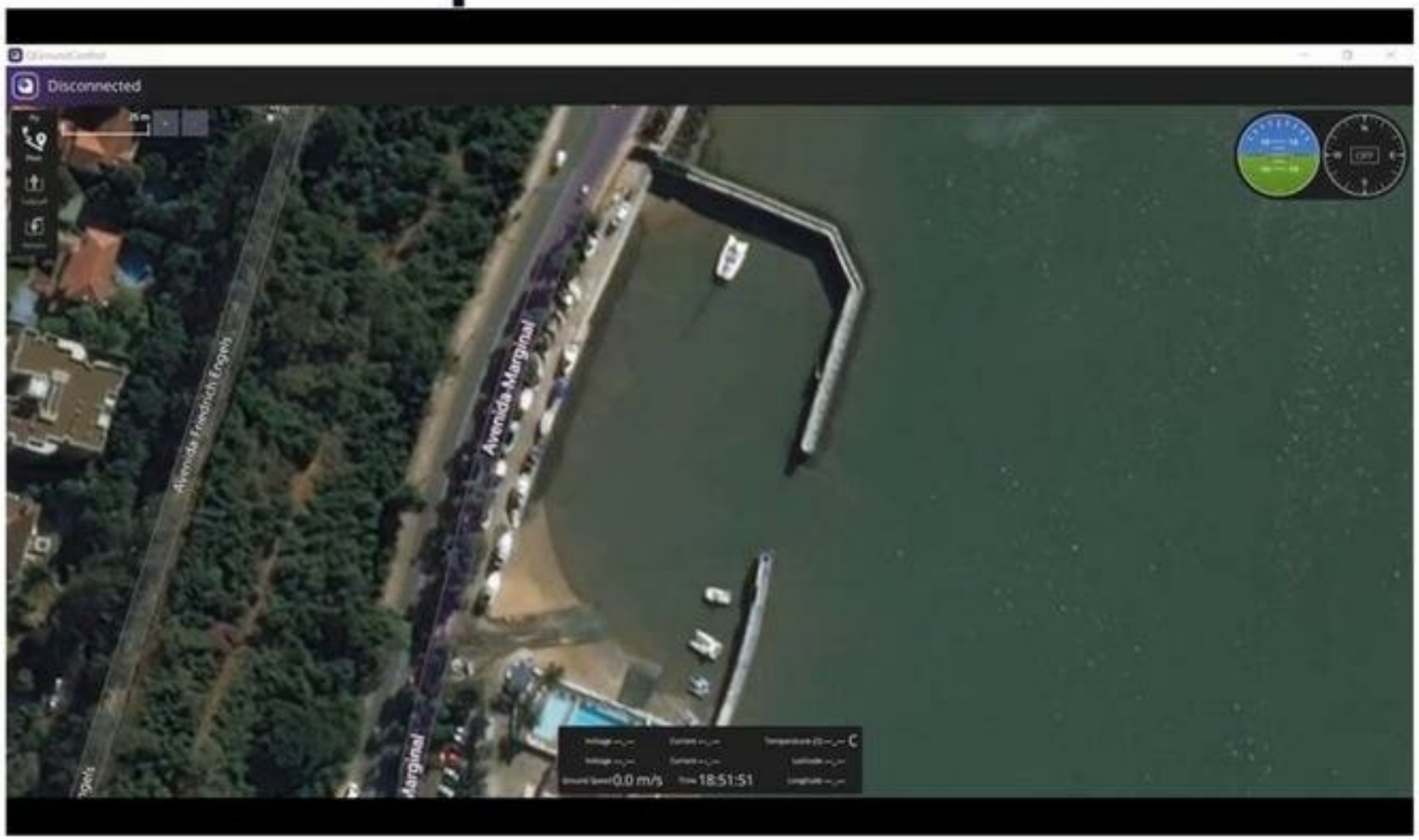
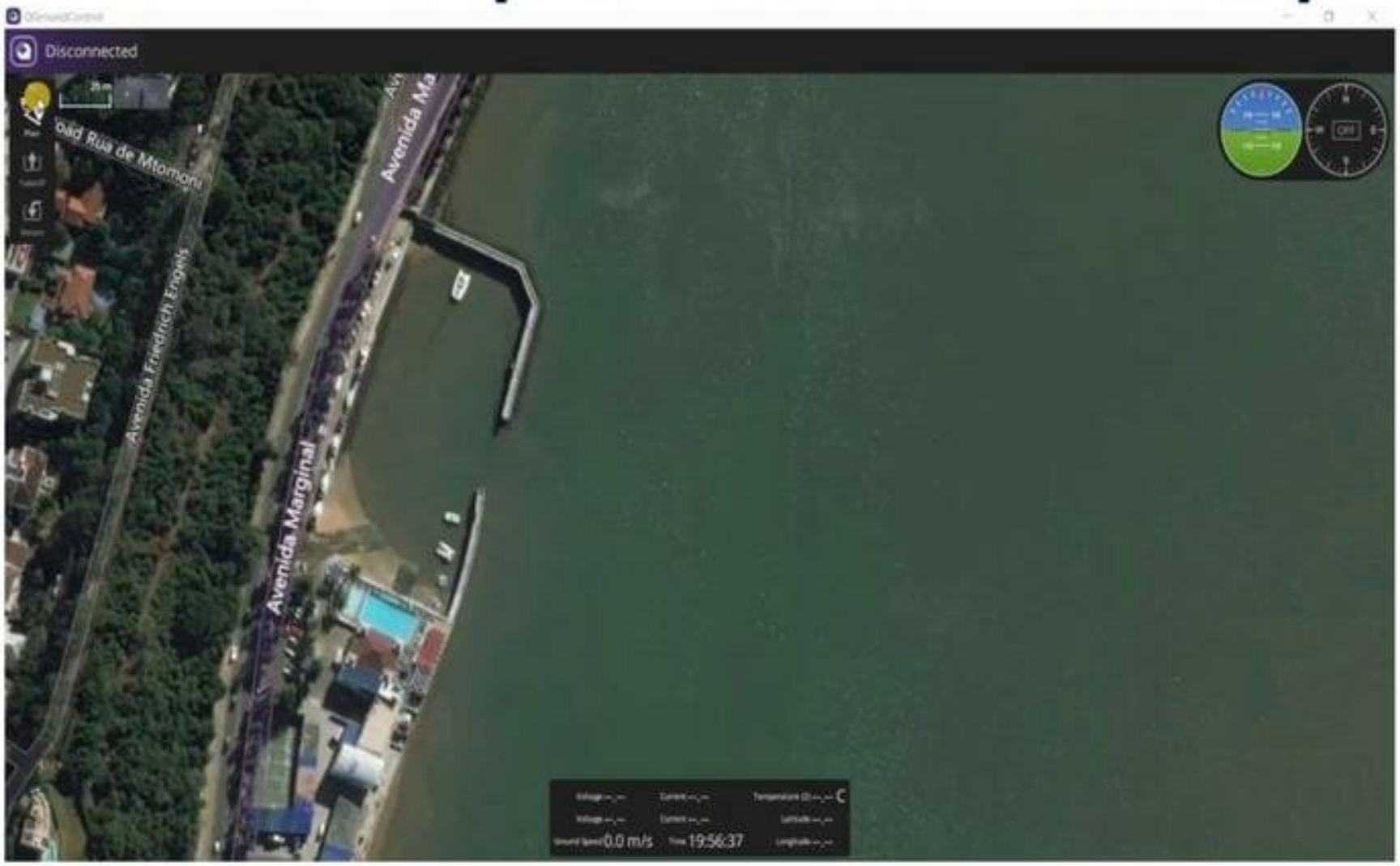
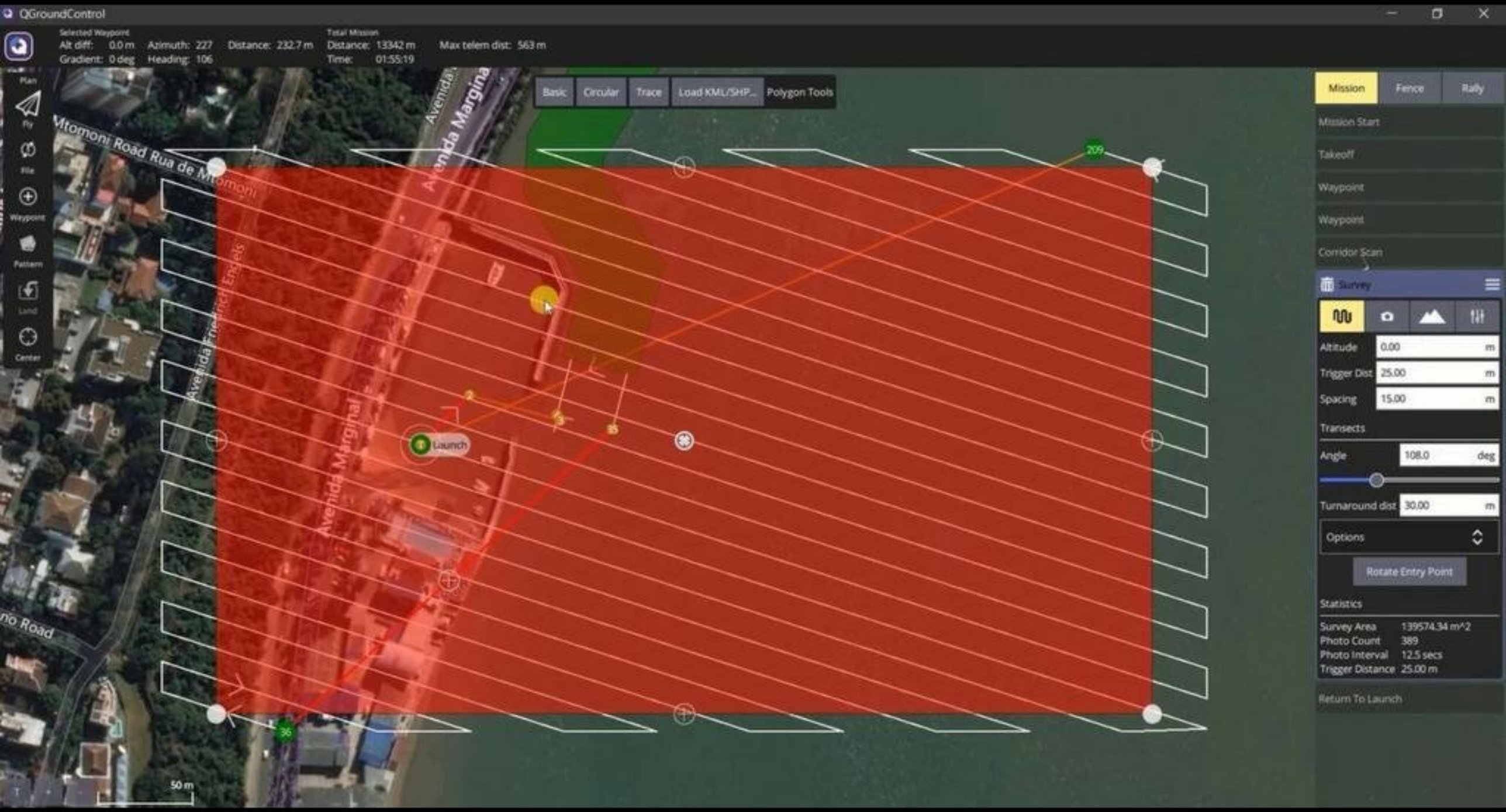


Mozambique demo - location

Mozambique demo - setup




QGroundControl
Selected Waypoint
Alt diff: 0.0 m
Azimuth: 227
Distance: 232.7 m
Gradient: 0 deg
Heading: 106
Total Mission
Distance: 13342 m
Time: 01:55:19
Max telem dist: 563 m
Plan
Fly
File
Waypoint
Pattern
Land
Center
Basic
Circular
Trace
Load KML/SHP...
Polygon Tools
Mtomoni Road Rua de Mtomoni
Avenida Margina
Avenida Friedrich Engels
Launch
209
Mission
Fence
Rally
Mission Start
Takeoff
Waypoint
Waypoint
Corridor Scan
Survey
Altitude 0.00 m
Trigger Dist 25.00 m
Spacing 15.00 m
Transects
Angle 108.0 deg
Turnaround dist 30.00 m
Options
Rotate Entry Point
Statistics
Survey Area 139574.34 m^2
Photo Count 389
Photo Interval 12.5 secs
Trigger Distance 25.00 m
Return To Launch
50 m

QGroundControl

Selected Waypoint
Alt diff: 0.0 m Azimuth: 193 Distance: 255.6 m
Gradient: 0 deg Heading: 106

Total Mission
Distance: 13365 m Max telem dist: 563 m
Time: 01:57:28

Plan
Fly
File
Waypoint
Pattern
Land
Center

Basic | Circular | Trace | Load KML/SHP... | Polygon Tools

Avenida Friedrich Engels
Avenida Marginal
Launch
203

Mission | Fence | Rally

Mission Start
Takeoff
Waypoint
Waypoint
Corridor Scan

Survey

Altitude 0.00 m
Trigger Dist 25.00 m
Spacing 15.00 m

Transects

Angle 108.0 deg
Turnaround dist 30.00 m

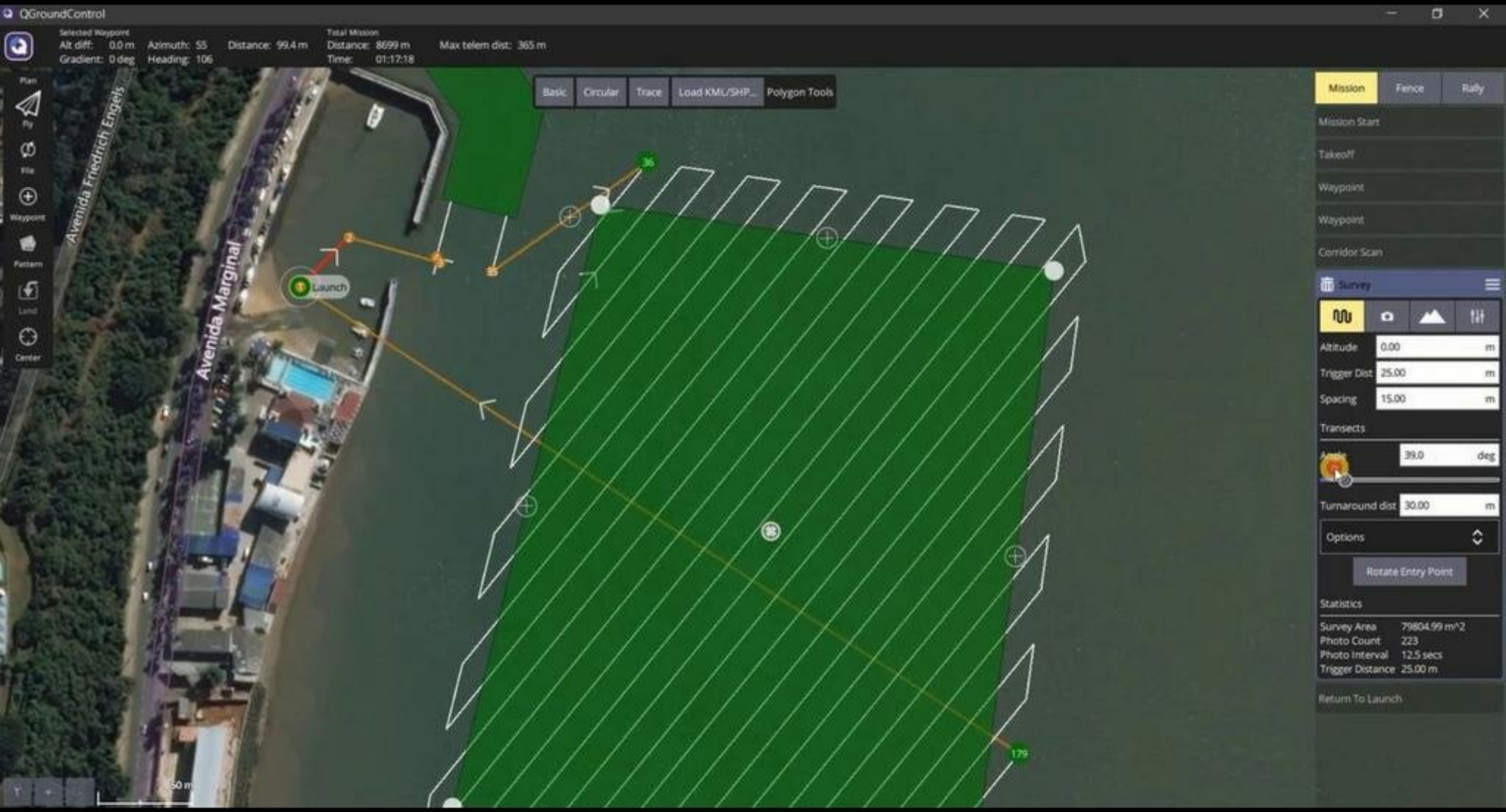
Options

Rotate Entry Point

Statistics

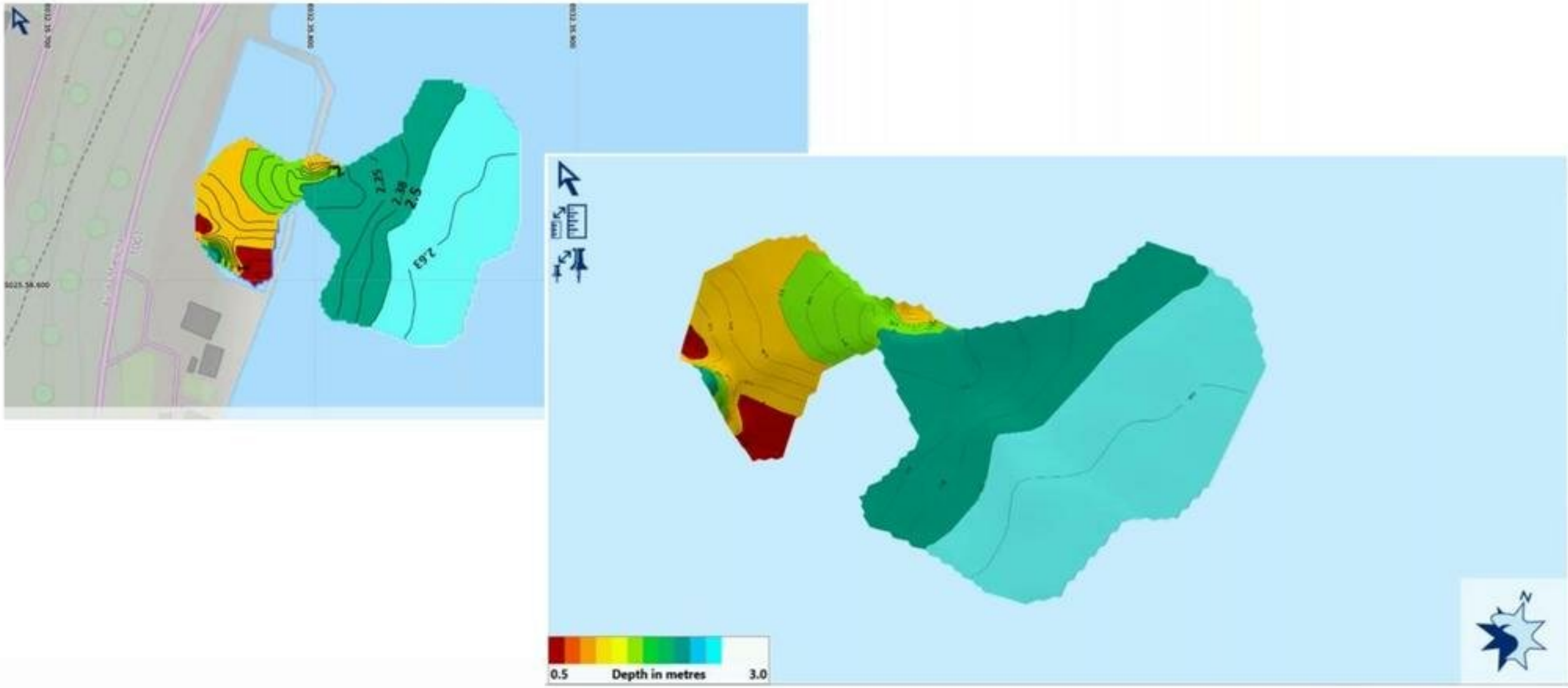
Survey Area	139414.55 m^2
Photo Count	388
Photo Interval	12.5 secs
Trigger Distance	25.00 m

Return To Launch

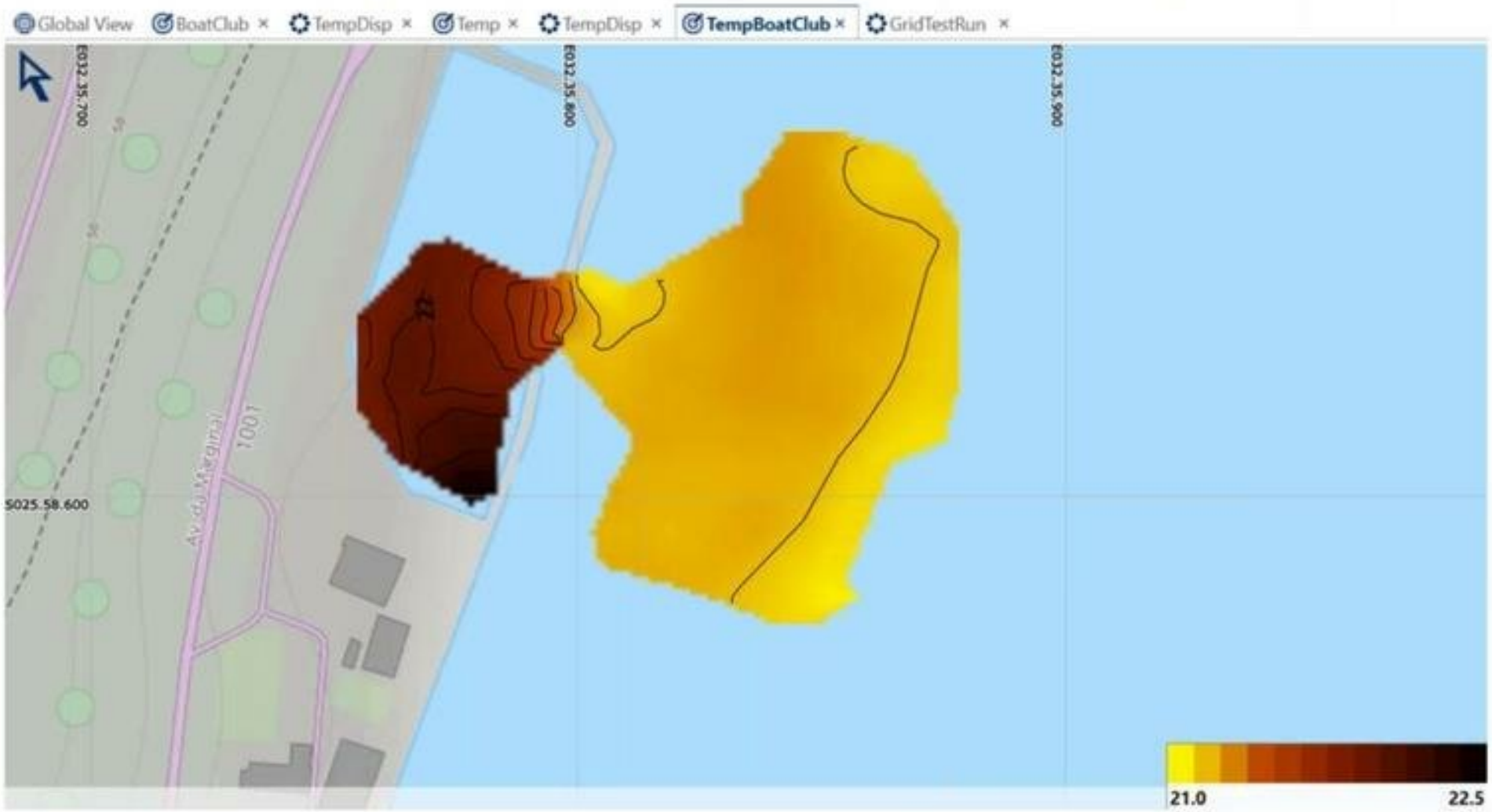

QGroundControl
Selected Waypoint
Alt diff: 0.0 m
Azimuth: 55
Distance: 99.4 m
Gradient: 0 deg
Heading: 106
Total Mission
Distance: 8699 m
Time: 01:17:18
Max telem dist: 365 m
Plan
Fly
File
Waypoint
Pattern
Land
Center
Avenida Friedrich Engels
Avenida Marginal
Launch
Basic
Circular
Trace
Load KML/SHP...
Polygon Tools
Mission
Fence
Rally
Mission Start
Takeoff
Waypoint
Waypoint
Corridor Scan
Survey
Altitude 0.00 m
Trigger Dist 25.00 m
Spacing 15.00 m
Transects
39.0 deg
Turnaround dist 30.00 m
Options
Rotate Entry Point
Statistics
Survey Area 79804.99 m^2
Photo Count 223
Photo Interval 12.5 secs
Trigger Distance 25.00 m
Return To Launch
50 m

Mozambique demo - setup

Mozambique demo - Depth



Mozambique demo - Temperature



Thank you

Questions?